TERMINAL LEARNING OBJECTIVE

ACTION

Describe the operation of 4 Bit Storage, 4 and 8 Bit Shift registers and a 64 bit memory circuit.

CONDITION

Given a classroom environment, Computer Aided Instruction (CAI) workstation, NIDA 130 Electronic Trainer, Digital Multimeter w/test leads, and official OMEMS reference material.

STANDARD

Correctly answer 18 of 25 questions concerning 4 Bit Storage, 4 and 8 Bit Shift registers and a 64 bit memory circuit.

CLASSIFICATION:	UNCLASSFIED
SAFETY CONSIDERATIONS:	ELECTRICAL SHOCK HAZARD
	ELECTOSTATIC DISCHARGE
ENVIRONMENTAL:	NONE
RISK ASSESMENT:	LOW

ENABLING LEARNING OBJECTIVE 1

ACTION

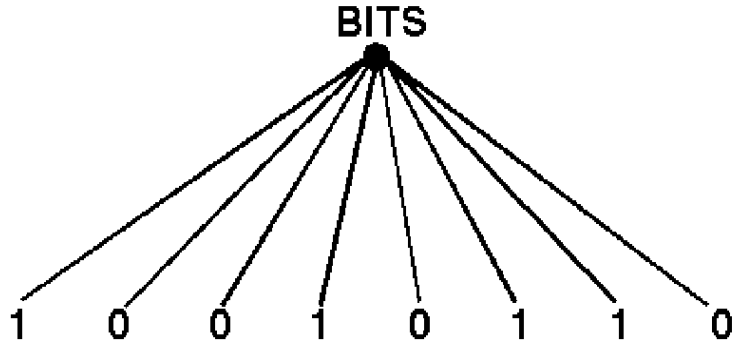
Describe the operation of 4 Bit Storage, 4 and 8 Bit Shift registers.

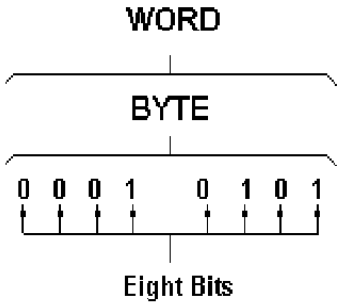
CONDITION

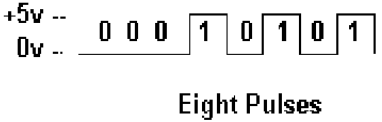
Given a classroom environment, Computer Aided Instruction (CAI) workstation, NIDA 130 Electronic Trainer, Digital Multimeter w/test leads, and official OMEMS reference material.

STANDARD

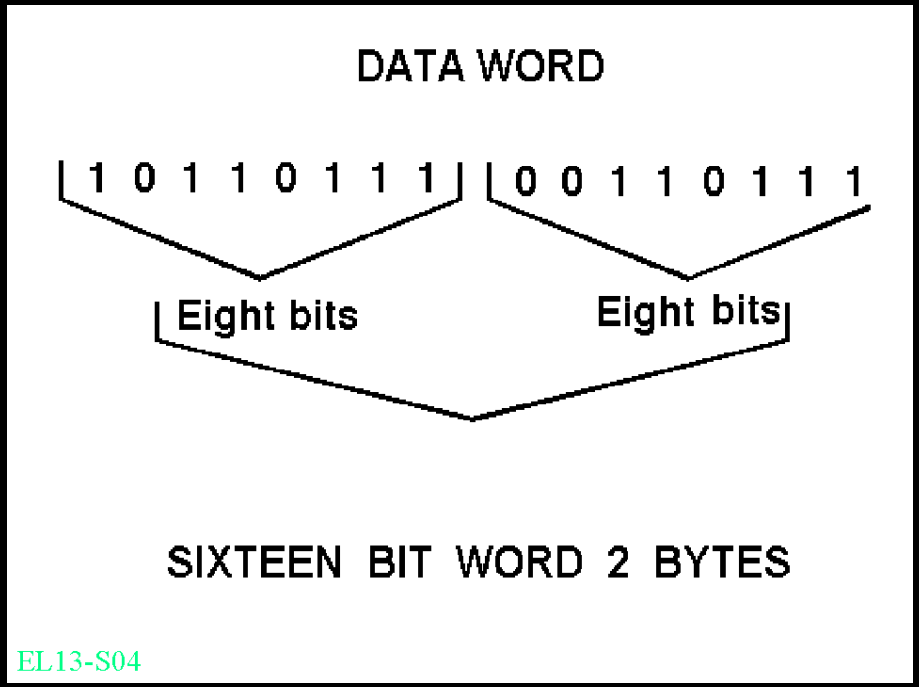
Correctly answer 18 of 25 questions concerning 4 Bit Storage, 4 and 8 Bit Shift registers and a 64 bit memory circuit


BITS
1
0
0
1
0
1
1
0
BINARY DIGITS

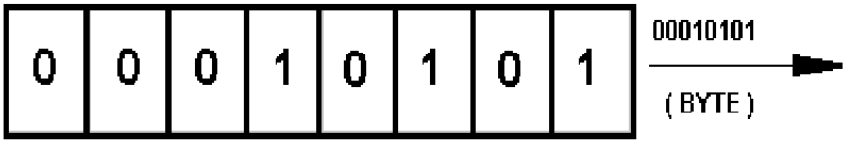




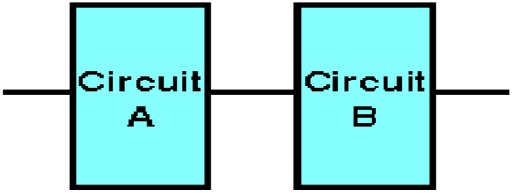
EIGHT BIT WORD (BYTE)


DATA WORD
1 0 1 1 0 1 1 1
0 0 1 1 0 1 1 1
Eight bits
Eight bits
SIXTEEN BIT WORD 2 BYTES

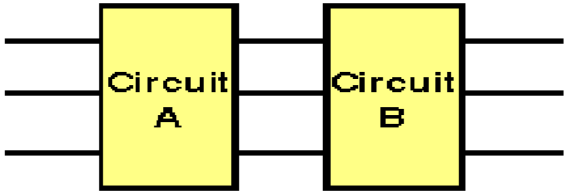
EL13-S04



REGISTERS STORE AND TRANSFER BINARY DIGITS

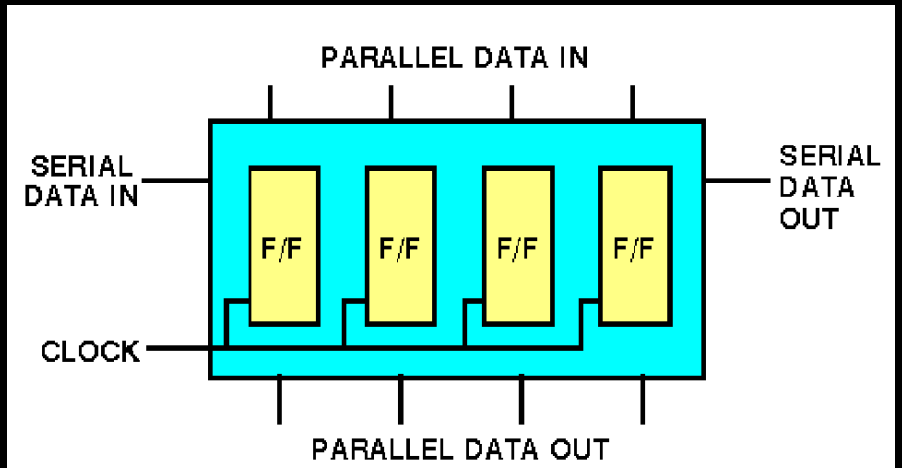


SERIAL

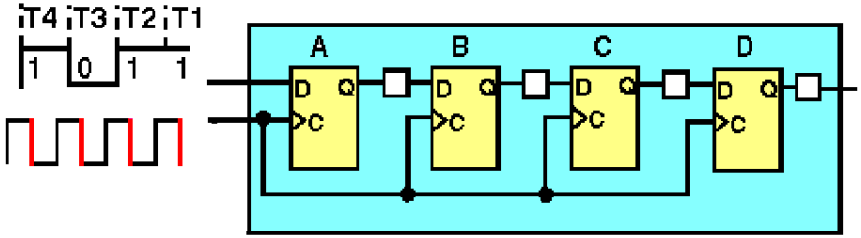


PARALLEL

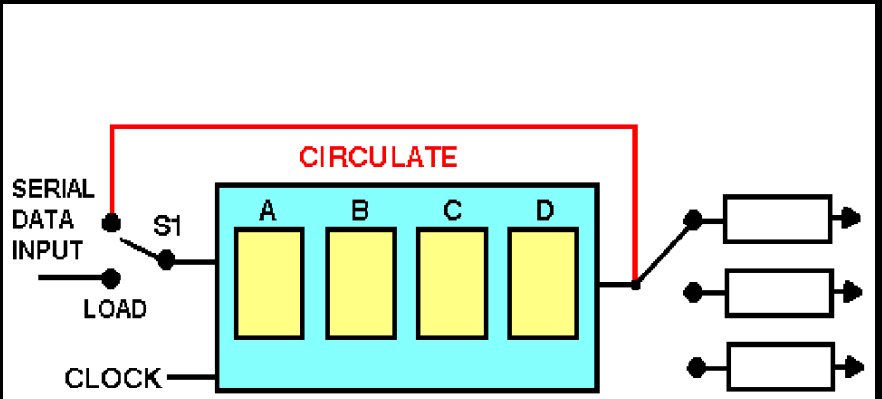
REGISTERS STORE AND TRANSFER BITS
SERIALLY OR IN PARALLEL



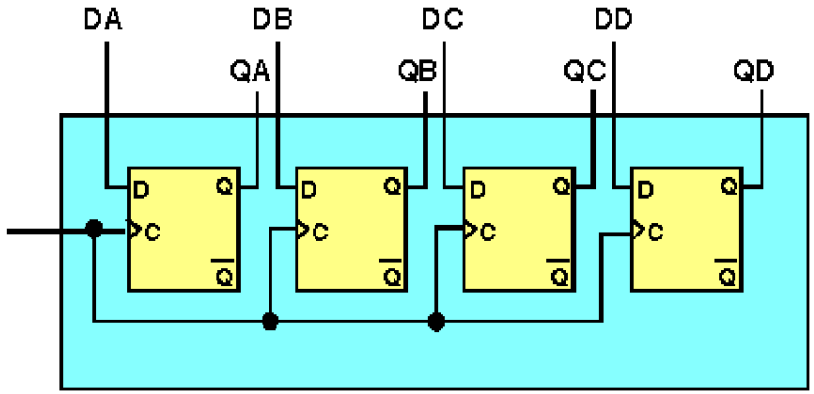
REGISTER STORAGE CAPACITY



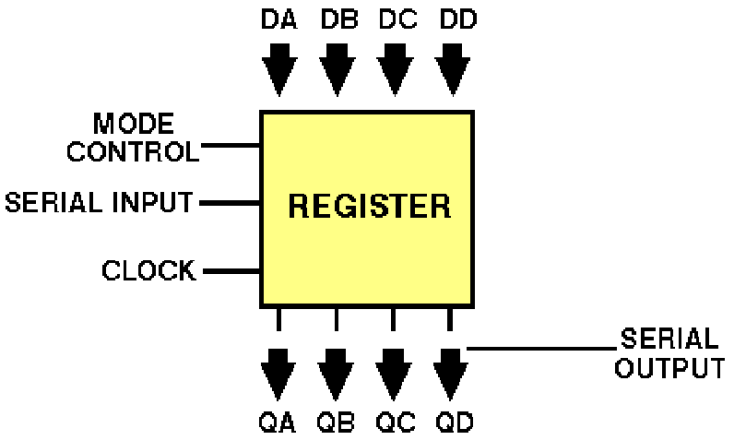
4 BIT SERIAL STORAGE REGISTER



4 BIT REGISTER

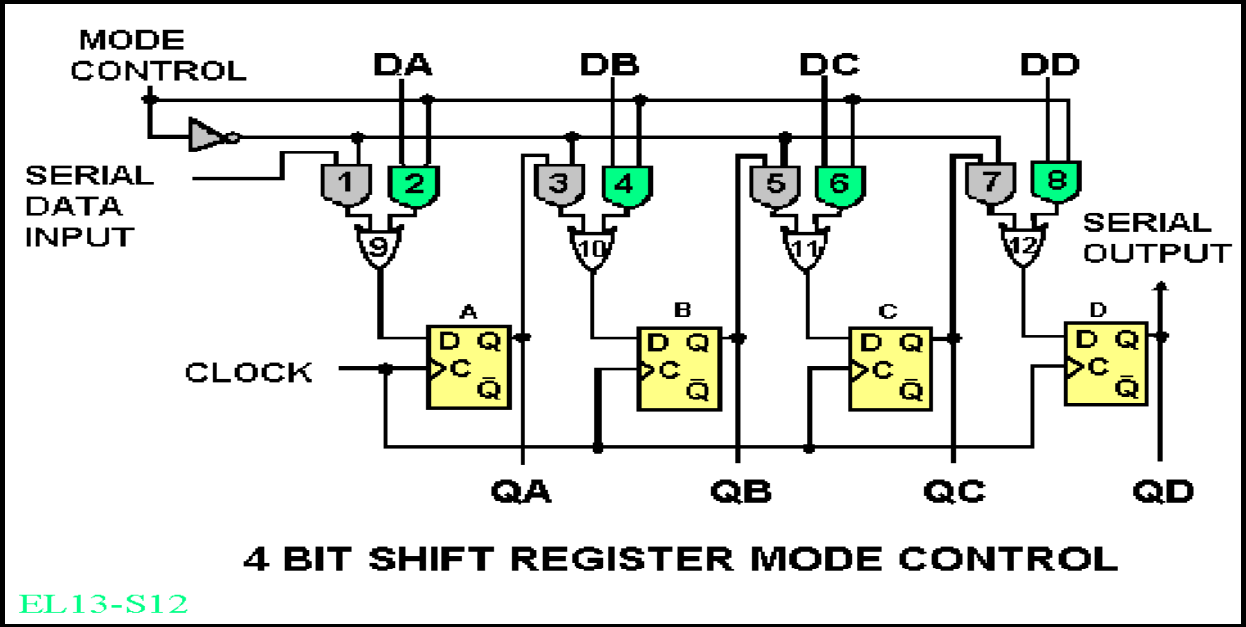


4 BIT PARALLEL STORAGE REGISTER



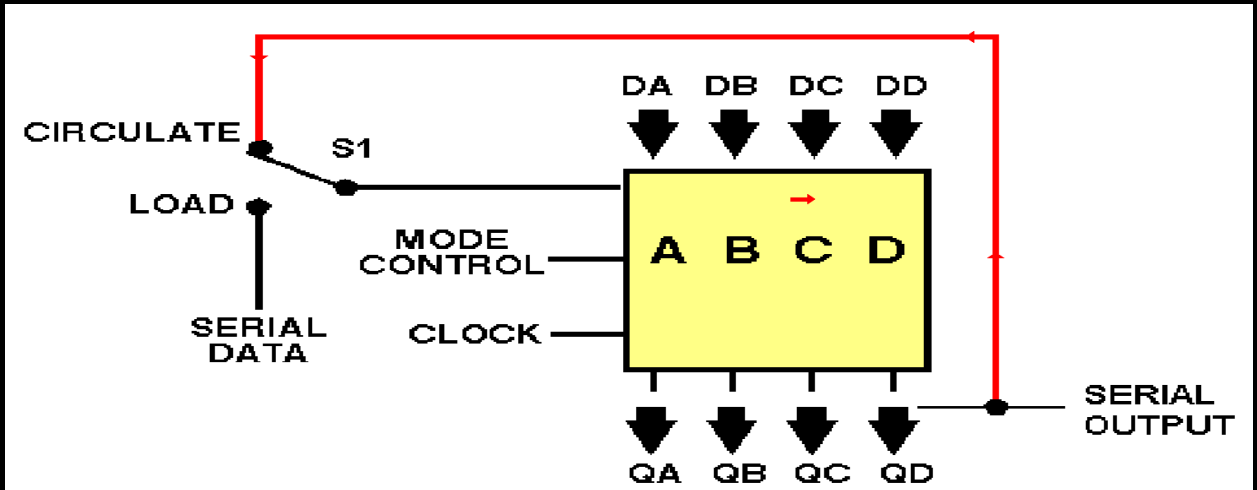
4 BIT SHIFT REGISTER MODE CONTROL

EL13-S11

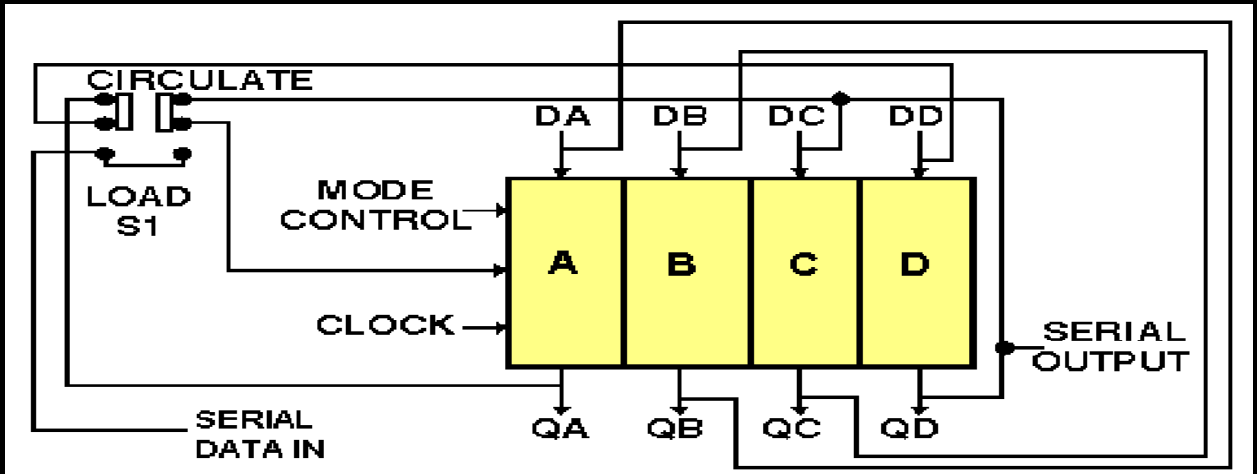


4 BIT SHIFT REGISTER MODE CONTROL

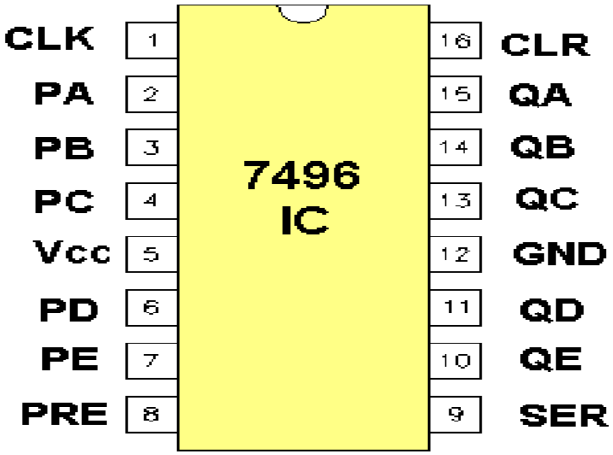
EL13-S12


DA DB DC DD
CIRCULATE
S1
LOAD
MODE CONTROL
A B C D
SERIAL DATA
CLOCK
SERIAL OUTPUT
QA QB QC QD
SHIFT RIGHT

EL13-S13

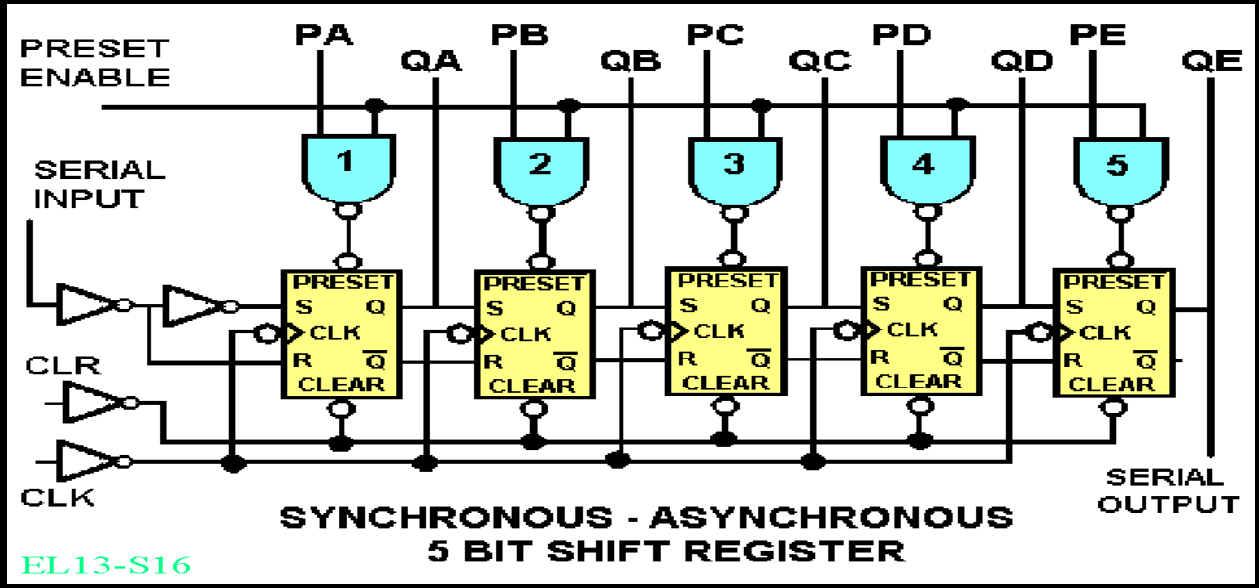


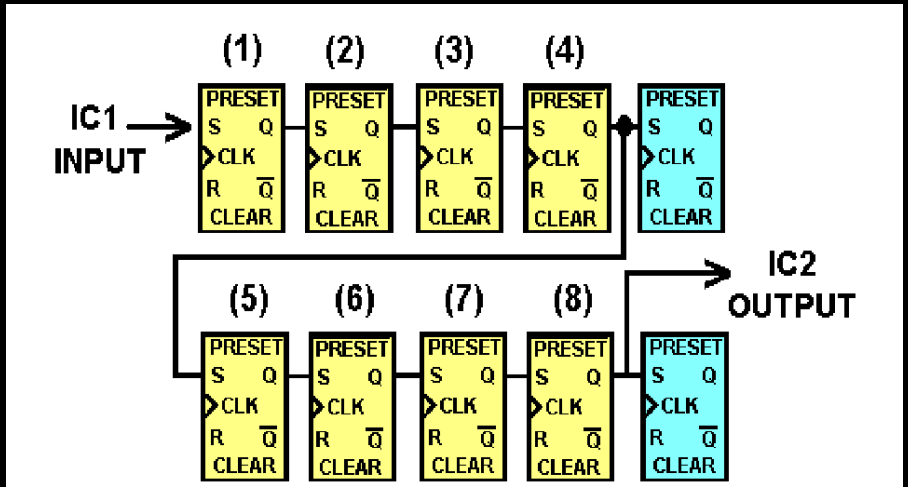
SHIFT LEFT/RIGHT - LOAD LEFT/RIGHT



SYNCHRONOUS - ASYNCHRONOUS
5 BIT SHIFT REGISTER

EL13-S15


PRESET ENABLE
PA
QA
PB
QB
PC
QC
PD
QD
PE
QE
SERIAL INPUT
1
2
3
4
5
PRESET
S Q
CLK
R Q
CLEAR
CLR
CLK
SERIAL OUTPUT
SYNCHRONOUS - ASYNCHRONOUS
5 BIT SHIFT REGISTER
EL13-S16



Two Five Bit Registers As An Eight Bit Register

What is a byte of digital information ?

1. Eight words
2. Eight bits
3. Eight bytes
4. Eight digits

How is the storage, or memory, capability of a register accomplished ?

1. Using comparators.

2. Using logic gates.

3. Using flip-flops.

4. Using decorders.

What is added to a register to prevent the contents from being lost when data is serially shifted out ?

1. Parallel outputs
2. Parallel inputs
3. Circulate path
4. Serial outputs

What is the purpose of the mode control input to a shift register ?

1. Connects the parallel outputs to the parallel inputs.
2. Connects the parallel outputs to the serial inputs.
3. Sets the register for serial or parallel transfer.
4. Sets the register to circulate.

How is data shifted automatically ?

1. Asynchronous
2. Synchronous
3. Parallel
4. Serial

When using a serial input - serial output storage register, how many clock pulses does it require to clock a four bit binary word in or out ?

1. 1
2. 2
3. 3
4. 4

What is the purpose of a register ?

1. Stores data only.
2. Transfers data only.
3. Stores and transfers data.
4. Transfers data left or right.

When is the data available at the output of a four bit register in a parallel operation ?

1. After four clock pulses.

2. After one mode pulse.

3. As soon as its clocked in.

4. After two clock pules.

ENABLING LEARNING OBJECTIVE 2

Describe the purpose and operation of memory.

ENABLING LEARNING OBJECTIVE 2

ACTION

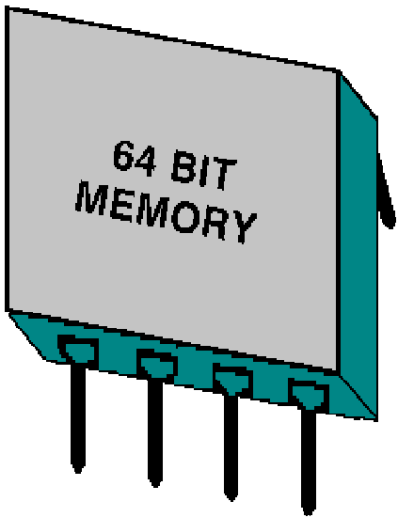
Describe the purpose and operation of memory.

CONDITION

Given a classroom environment, Computer Aided Instruction (CAI) workstation, NIDA 130 Electronic Trainer, Digital Multimeter w/test leads, and official OMEMS reference material.

STANDARD

Correctly answer 18 of 25 questions concerning 4 Bit Storage, 4 and 8 Bit Shift registers and a 64 bit memory circuit



64 BIT MEMORY

MEMORY WORD

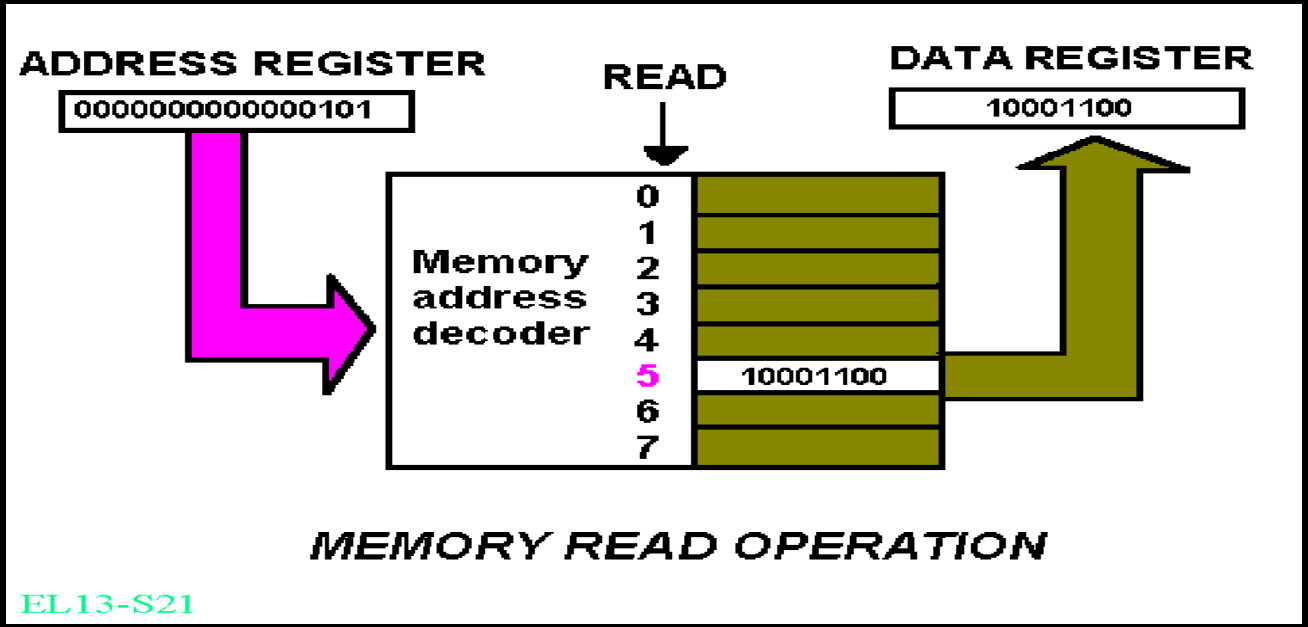
The memory capacity divided by the number of bits in each memory register equals the number of words that a memory can store.

$\frac{\text{128 BIT MEMORY}}{\text{8 BIT REGISTER}}$	=	16 Words
$\frac{\text{2K BIT MEMORY}}{\text{8 BIT REGISTER}}$	=	? 250 words

MEMORY CAPACITY

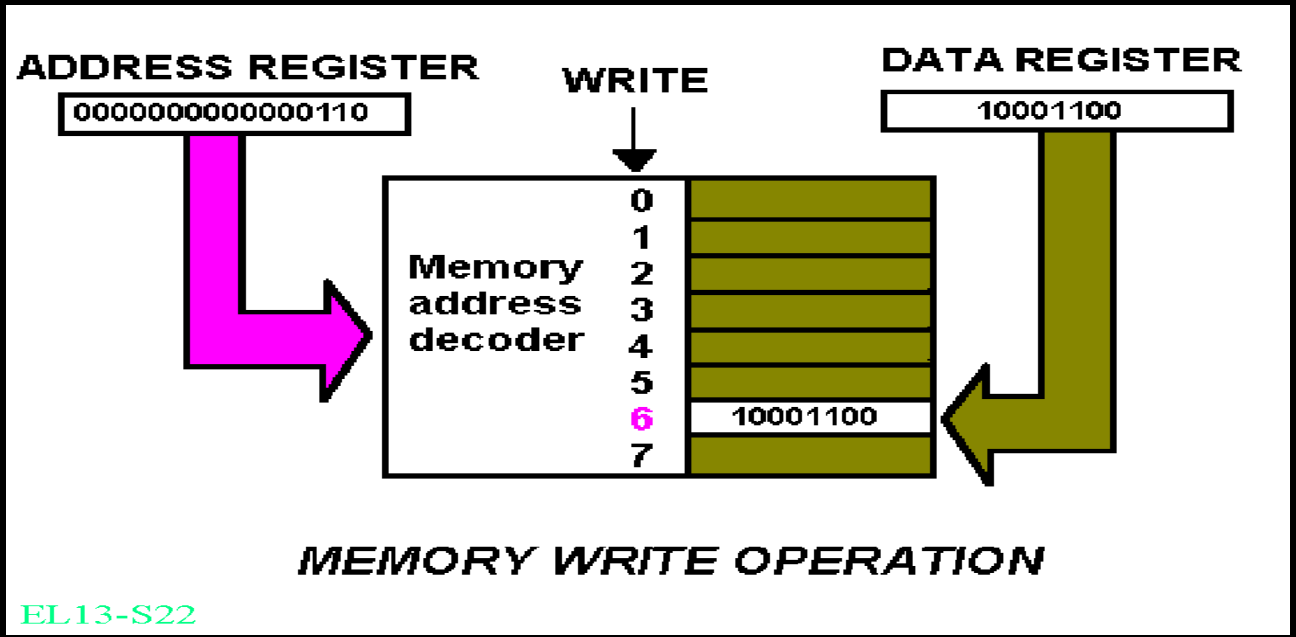
The total number of bits that a memory can store is its capacity. Bits stored in memory are stored in registers. The number of registers times the number of bits in each register equals the memory capacity.

16 x 8 BIT REGISTERS	=	128 BIT MEMORY
2K x 8 BIT REGISTERS	=	? 16 k



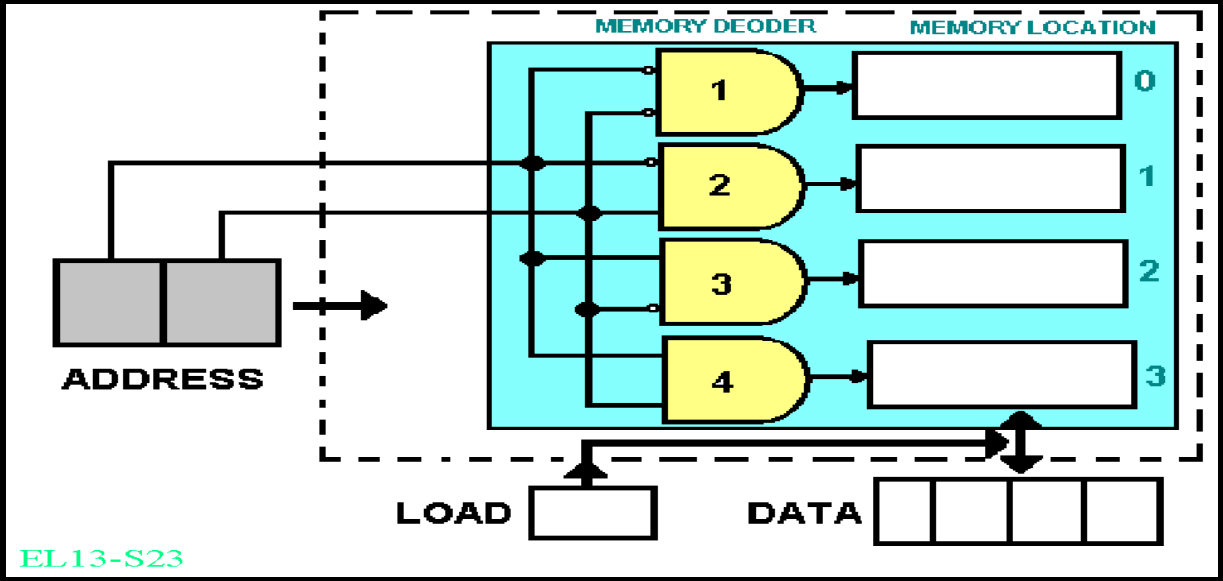
MEMORY READ OPERATION

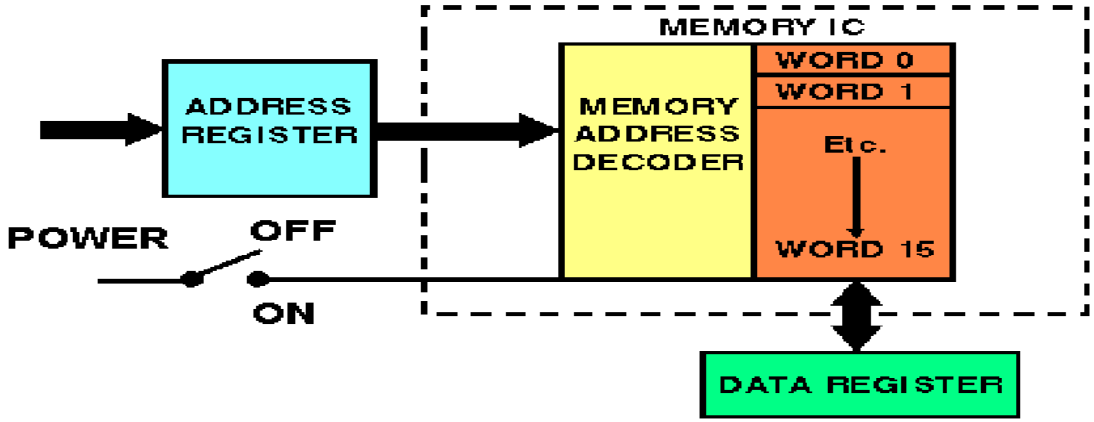
EL13-S21



MEMORY WRITE OPERATION

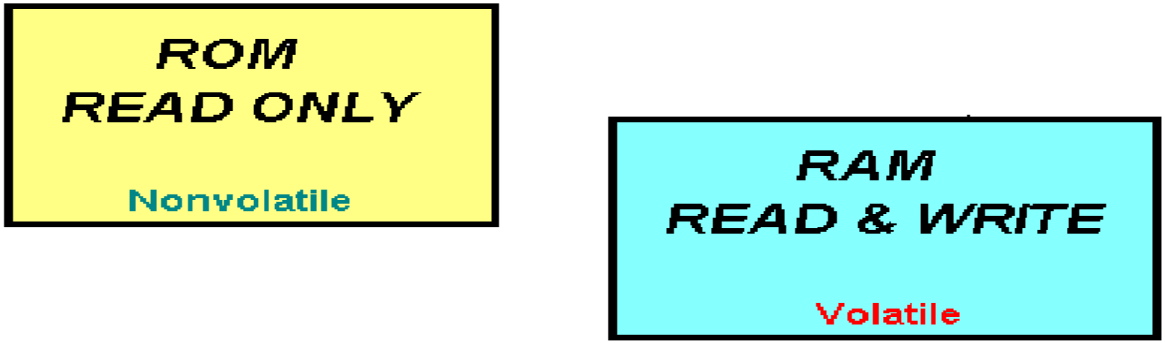
EL13-S22


MEMORY DEODER
MEMORY LOCATION
1
2
3
4
0
1
2
3
ADDRESS
LOAD
DATA
EL13-S23

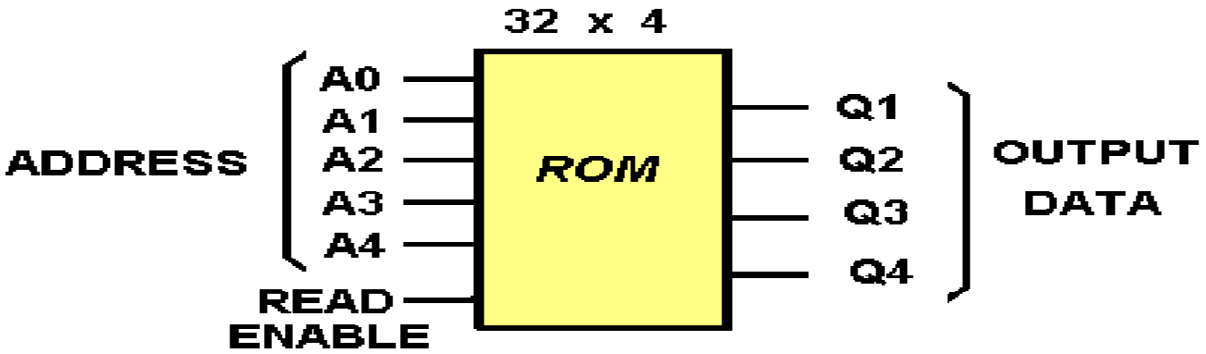


Volatile And Nonvolatile Memory

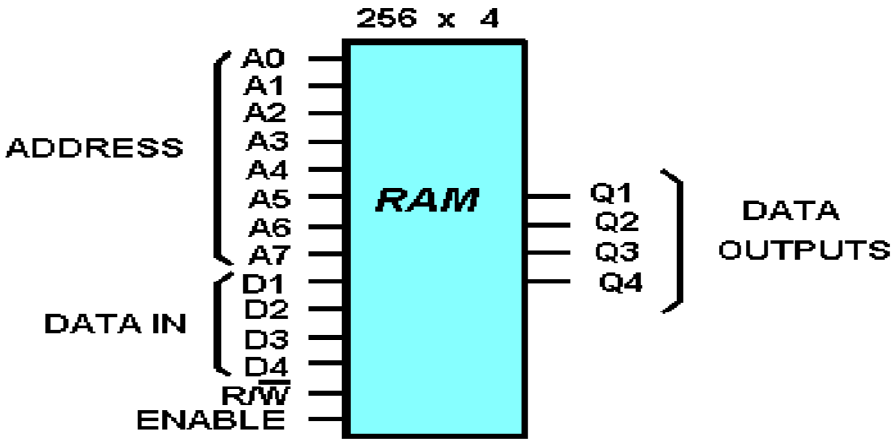
EL13-S24



Semiconductor Memories



ROM Structure



RAM Structure

EL13-S27

EL13-S27.1

What is the difference between RAM and ROM memory ?

1. None
2. RAM can only read and ROM can read and write
3. RAM and ROM can be only read
4. ROM can only read and RAM can read and write

What is the purpose of a memory circuit ?

1. Transfer data from one circuit to another.
2. Store binary data for future processing.
3. Change parallel data to serial data.
4. Change binary data to decimal.

ENABLING LEARNING OBJECTIVE 3

ACTION

Complete CAI lessons on 4 bit and 8 bit shift and storage registers and memory circuits.

CONDITION

Given a classroom environment, Computer Aided Instruction (CAI) workstation, NIDA 130 Electronic Trainer, Digital Multimeter w/test leads, and official OMEMS reference material.

STANDARD

Correctly answer 18 of 25 questions concerning 4 Bit Storage, 4 and 8 Bit Shift registers and a 64 bit memory circuit

ENABLING LEARNING OBJECTIVE 4

ACTION

Perform troubleshooting procedures on 4 bit and 8 bit shift and storage registers and memory circuits.

CONDITION

Given a classroom environment, Computer Aided Instruction (CAI) workstation, NIDA 130 Electronic Trainer, Digital Multimeter w/test leads, and official OMEMS reference material.

STANDARD

Correctly identify 10 of 10 malfunctions in 4 Bit Storage, 4 and 8 Bit Shift registers and memory circuits.